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STATUS REVIEW OF Lesquerella carinata

and Lesquerella paysonii

U.S.D.A. FOREST SERVICE - REGION 1

DEERLODGE NATIONAL FOREST

MONTANA

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SUMMARY

This study was initiated as a survey for Lesquerella carinata, a regional endemic currently known from east-central Idaho, northwest Wyoming, and west-central Montana. After two years of survey and study, there are three verified records for L. carinata in Montana, all in Granite County. Also, there is one unverified site (Nemesis Mountain (001)) in the Centennial Mountains of southeastern Beaverhead County. During the fall of 1990, Dr. Rollins reviewed plant specimens collected from the Granite County, Montana populations of Lesquerella carinata. In a letter to the Montana Natural Heritage Program dated November 20, 1990, Dr. Rollins stated that the collections from the three L. carinata populations "represented a separate taxon (from the Idaho and Wyoming populations) perhaps at the subspecific level," but he required more material in mature fruit to make a final decision. Lesquerella carinata is also known from a number of large populations in Lemhi County, Idaho, and from four locations in Teton County, Wyoming. The three Montana populations are restricted to high-calcium limestone-derived substrates, and occur in ecotonal areas between ponderosa pine/ bitterbrush and bitterbrush/grassland habitat types. The isolation of the L. carinata populations in Montana from those in Idaho and Wyoming bolsters Dr. Rollins' case for a possible divergence of the Montana populations at the subspecific level. Specimens from a fourth population at Emerine Gulch in Granite County were originally determined to be L. carinata by Dr. Rollins. During the present study Dr. Rollins was able to make a comparison of several older collections with several recent collections. He was able determine that the specimens from Emerine Gulch actually represent a population of L. paysonii. This is the first record for this species in Montana; it was previously known only from Idaho and Wyoming (Hitchcock *et al.* 1964). The L. paysonii population at Emerine Gulch (001) also occurs on limestone, with a soil pH of 8.2. Little is known of the life history patterns of this apparently short-lived perennial. The establishment of a monitoring transect could reveal important life history information on the species' life span, fecundity, and population dynamics. In Wyoming there are 16 locations reported for L. paysonii, however, the identity of five sites is uncertain, owing to the lack of specimens with mature fruit. There is only one recorded population in Idaho. Therefore, it is recommended that L. paysonii be included on the sensitive species list for Region 1 of the U.S. Forest Service. Weed control activities aimed at reducing spotted knapweed are a major threat to both species. Land managers should be made aware of the location of L. carinata and L. paysonii to ensure that populations are not inadvertently eliminated.

I. INTRODUCTION

This study was initiated as a survey for Lesquerella carinata, a regional endemic currently known from east-central Idaho, northwest Wyoming, and west-central Montana. During the study, the only population on the Deerlodge National Forest was redetermined by Dr. Reed Rollins, Harvard University Herbaria, as Lesquerella paysonii. Lesquerella paysonii is also a regional endemic, known from northwest Wyoming and one site in Idaho, and now Montana. The following report gives detailed information on these two taxa, gained from field surveys and office research conducted by the Montana Natural Heritage Program.

II. METHODS

Information on locations of Lesquerella carinata sites was obtained from the Montana Natural Heritage Program data base. Based on habitat characteristics of these known locations, other areas containing potential habitat were surveyed on the Deerlodge National Forest, and to the north of Interstate 90 between Nimrod Warm Springs and Drummond, Montana. Areas surveyed in which populations were not found, are listed in Appendix A, p. 40. During survey work, complete specimen collections were made from each population. These specimens were sent to an expert in the genus Lesquerella, Dr. Reed C. Rollins (Harvard University, Gray Herbarium), for his review and determination. In addition, soil pH was measured for one population at Emerine Gulch, using a Hellige-Truog soil reaction (pH) tester.

This report includes the results of surveys carried out by the Montana Natural Heritage Program in 1989 and 1990. Field surveys were completed as follows:

Lisa Schassberger and J. Stephen Shelly, 24-26 May 1989
Lisa Schassberger, 31-2 May/June 1989

Lisa Schassberger, 11-13 June 1990
Diane Pavek, 11-15 June 1990

Throughout this report, the three-digit occurrence numbers are indicated in parentheses after the site names (e.g. Emerine Gulch (001)); these correspond to the occurrence numbers provided in the tables, element occurrence print-outs and maps.

III. RESULTS

Distribution

The main range of L. carinata is centered in south-central Idaho, in the Lemhi Range and the Lost River Mountains in Lemhi County. The species is also known from locations near Teton Pass, in Teton County, Wyoming. Prior to this survey, L. carinata was also known from four verified locations in Montana. The 24-26

May and 31 May-2 June 1989 field surveys in Montana revealed two previously undocumented occurrences of L. carinata, and extended the range of one known population approximately one-half mile to connect with and include a historic record. Thus, with the addition of two new records and the merging of two records, the total number of recorded populations at the end of 1989 was five. During field surveys of 11-15 June 1990, the boundary of the Rattler Gulch (003) population was extended approximately two miles to the west, to connect with and include a population located in 1989 on Mulkey Gulch. Thus, with the merger of two more records, the total number of documented and verified populations in Montana stood at four.

In the fall of 1990, Dr. Rollins reviewed plant specimens collected from all the Montana populations of Lesquerella carinata that had been recently located or relocated. In a letter to the Montana Natural Heritage Program dated November 20, 1990, Dr. Rollins stated that the collections from three of the L. carinata populations (Rattler Gulch (003), Bear Creek Cliffs (004), Felan and Packer Gulches (005)) "represented a separate taxon (from the Idaho and Wyoming populations) perhaps at the subspecific level", but he required more material to make a final decision. As a result of the surveys and the determinations, the total number of confirmed L. carinata populations in Montana currently stands at three.

During the same study, Dr. Rollins re-examined an older collection from Emerine Gulch, Lesica (3751) 1986 (GH), which he had previously determined to be L. carinata. After review of all the available specimens, he determined that the collections from this site were actually L. paysonii. This is a first record for L. paysonii in Montana. Until this determination, L. paysonii was known only from Wyoming and Idaho (Hitchcock et al. 1964). The main range of L. paysonii is in northwest Wyoming in Teton, Sublette and Lincoln counties, with one historic population known from Bonneville County, in south-central Idaho.

An unverified population (Nemesis Mountain (001)) of L. carinata is represented by a specimen (Lowry II (2090) collected in June of 1979, from southwest Montana. The specimen was collected from an alpine scree slope, at an elevation of 9,339 ft. (2,847 m), from Nemesis Mountain, in the Centennial Mountains in southeast Beaverhead County. Only immature fruits are present on the specimen, and mature fruits are necessary for certain identification of this species. A collection with mature fruit will be necessary before this site is verified. It is possible that this is a population of L. paysonii, but it will be considered here as L. carinata. Due to the unverified status of this population, it will be only briefly included in the discussions that follow. However, the information we have on this location is included in the element occurrence records, and it is marked on all maps within the report as L. carinata.

The location of L. paysonii, and the three verified and one unverified locations of L. carinata in Montana, are shown in Figure 1, p. 4.

The legal descriptions, latitude and longitude, elevations, USGS topographic map names, locations of occurrences and mapped locations of populations in Montana are found in the Element Occurrence records and Maps for L. carinata and L. paysonii, Section V, pp. 20-32, and Section VI, pp. 33-39, respectively.

SPECIES

The genus Lesquerella was first described and published by S. Watson in 1888. There are approximately 69 species of Lesquerella found in North America (Rollins and Shaw 1973). According to Dorn (1984), four species occur in Montana. The addition of L. humilis and L. klausii by Rollins (1984), and now the recognition of the presence of L. paysonii, brings the total to number of Lesquerella species in Montana to seven.

Lesquerella paysonii is closely related to L. carinata; both are in the L. wardii-L. utahensis group. According to Rollins (1950), L. carinata "represents an extreme of the evolutionary line of development which led to it through L. paysonii."

Detailed descriptions and line drawings of each species are included here to help separate the two species.

Lesquerella carinata:

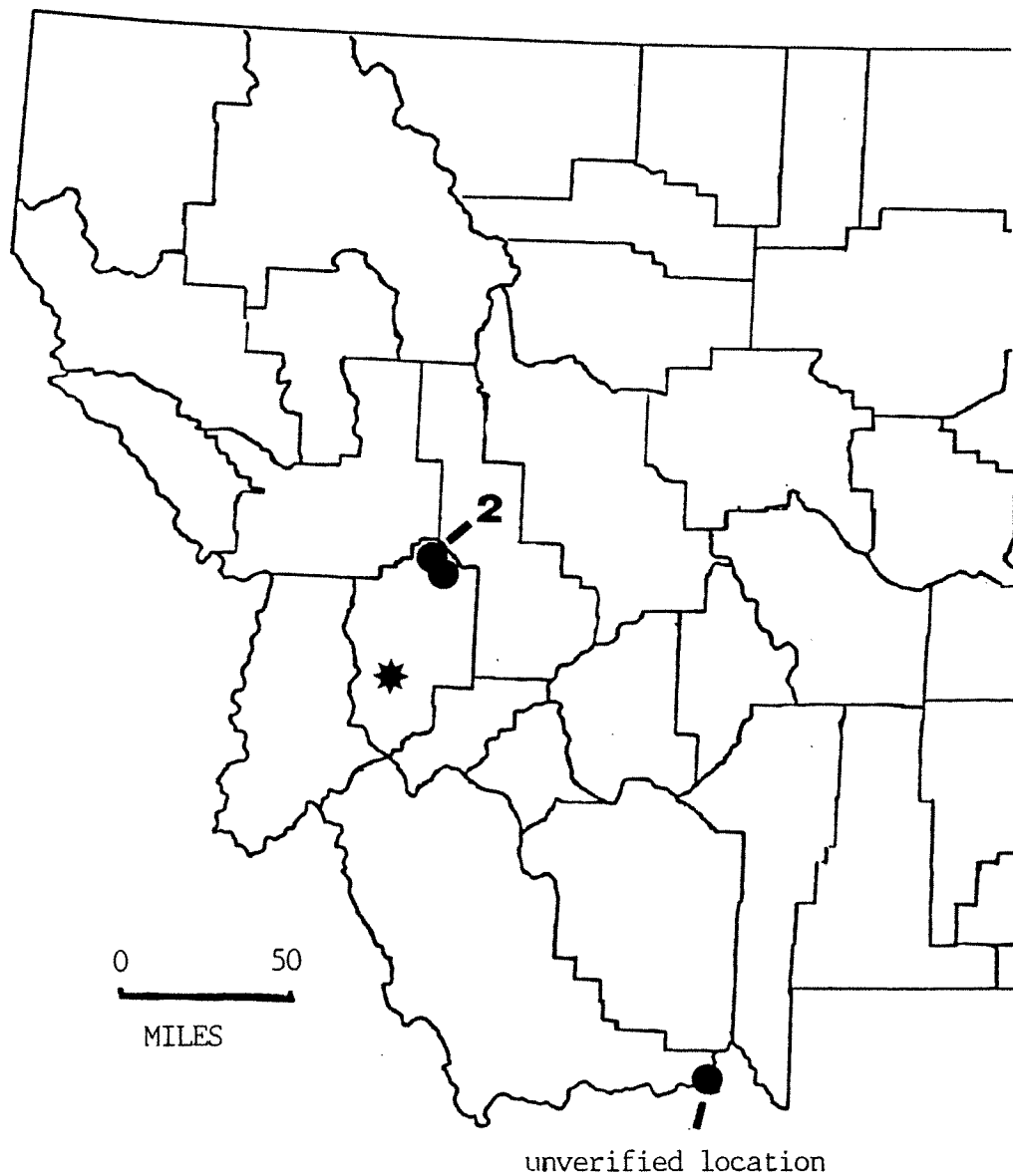
SCIENTIFIC NAME: Lesquerella carinata Rollins.

COMMON NAME: keeled bladderpod.

FAMILY: Brassicaceae (= Cruciferae, Mustard Family).

SPECIES: Lesquerella carinata was first described by Rollins (1950) from specimens collected in Idaho. The holotype (Davis (3801)) is deposited at the Gray Herbarium. It was first collected from west-central Montana, Granite County, where it was found to occur in lower elevation bitter-brush grasslands.

GENERAL NONTECHNICAL DESCRIPTION: Lesquerella carinata is a low-growing member of the Brassicaceae (Mustard Family), with prostrate or ascending stems that may reach six inches in length. Spoon-shaped leaves (1.5 inches in length) form a basal rosette from which the stems arise. Stem leaves by comparison, are much reduced in size, but are similar in shape to the basal leaves. A dense cover of appressed, branched hairs gives all the herbage a silvery appearance. One to numerous short-stalked flowers arise alternately



● - Lesquerella carinata

★ - Lesquerella paysonii

(Note: Where more than one population occurs at a dot, the number of populations is indicated.)

Figure 1. Distribution of populations of Lesquerella carinata and Lesquerella paysonii in Granite and Beaverhead counties, Montana.

along the ends of the stems. Each flower is composed of four bright yellow petals, subtended by 4 green sepals. A single plant will often produce more than 25, many-seeded fruits. The sutures of the fruits are raised to form a keel.

TECHNICAL DESCRIPTION: Plants short-lived perennials, densely pubescent; trichomes sessile or on a short stalk, finely granular, the rays numerous, distinct or slightly fused toward their bases, forked and sometimes bifurcate; stems 0.5-1.5 dm long, decumbent and usually unbranched, arising from a simple caudex; basal leaves 1.5-3 (4) cm long, 5-15 mm wide, the blade elliptic to broadly obovate or round, narrowing abruptly to the slender petiole; cauline leaves few, 0.5-1.5 cm long, 2-5 mm wide, oblanceolate to obovate, sessile or on a narrowed base; inflorescences compact, the buds ellipsoid; sepals 4-6.5 mm long, oblong to broadly elliptic, boat-shaped, the lateral saccate; petals yellow, 7.5-10 mm long, 3-4 mm wide, spatulate; filaments slender, not dilated; paired stamens 5.5-7 mm long, single stamens 5-6 mm long; glandular tissue pentagonal around the single stamens and subtending the paired stamens, but absent between the latter; infructescences loose and elongated, often secund; pedicels 4-10 mm long, straight to loosely sigmoid, ascending or divaricately spreading; siliques 5-9 mm long, sessile to substipitate, elliptic and strongly obcompressed, the valves sharply keeled, pubescent on the exterior and interior; septum entire, the funicles attached 1/3 to 1/2 their lengths; styles 2-4.5 mm long, slender, the stigmas capitate; ovules 4-7 per locule; seeds 2-2.5 mm long, suborbicular or oblong, only slightly flattened, reddish-brown, neither margined nor winged; cotyledons accumbent, as long as or shorter than the radicle (adapted from Rollins 1950).

LOCAL FIELD CHARACTERS: Slender, prostrate, spatulate-leaved stems, and obcompressed (compressed at right angles to the suture) fruits, distinguish this species from all other *Lesquerella* currently known to occur in Montana (except *L. paysonii*). Although *L. paysonii* also has obcompressed fruits, the sutures of the fruits in *L. carinata* are keeled, and the margins are more keeled than rounded. Specimens with mature fruits should be determined by an expert for certain verification. Figure 2, p. 6, is an illustration of *L. carinata*.

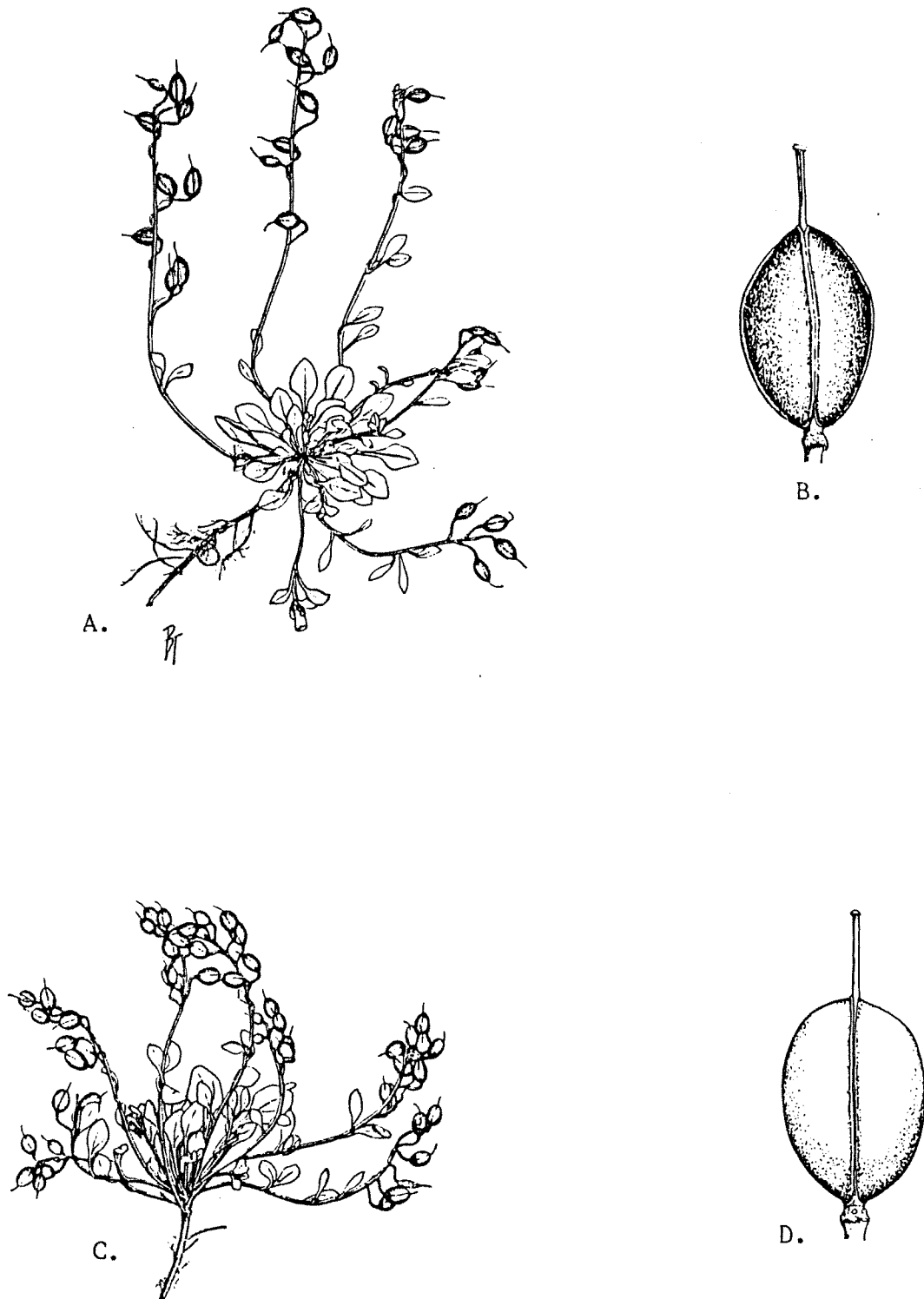


Figure 2. (A-B) *Lesquerella carinata*, (A) habit, (B) fruit;
 (C-D) *Lesquerella paysonii*, (C) habit, (D) fruit.
 From Rollins and Shaw (1973).

Lesquerella paysonii:

SCIENTIFIC NAME: Lesquerella paysonii Rollins.

COMMON NAME: Payson's bladderpod.

FAMILY: Brassicaceae (= Cruciferae, Mustard Family).

SPECIES: Lesquerella paysonii was first described by Rollins (1950) from specimens collected in Lincoln County, Wyoming. The holotype, Payson & Armstrong (3816), is deposited at the Gray Herbarium. This species was first collected (Harvey (7226)) from west-central Montana at Emerine Gulch, Granite County, in 1966. This Montana collection was designated as L. carinata until 1990. During a survey of specimens in 1990, with the aid of new material (Schassberger (368)), Dr. Rollins changed his determination of specimens from the Emerine Gulch location to L. paysonii.

GENERAL NONTECHNICAL DESCRIPTION: Lesquerella paysonii is a low-growing member of the Brassicaceae (Mustard Family), with prostrate or ascending stems that may reach six inches in length. Spoon-shaped leaves (1.5 inches in length) form a basal rosette from which the stems arise. Stem leaves by comparison, are much reduced in size, but are similar in shape to the basal leaves. A dense cover of appressed, branched hairs gives the herbage a silvery appearance. Arising alternately along the stem, are from one to numerous flowers on short stalks. Flowers also arise alternately along the stem, with each flower composed of four bright yellow petals, subtended by 4 green sepals. A single plant will often produce more than 25, many-seeded fruits. Fruits differ from L. carinata in having rounded rather than keeled sutures.

TECHNICAL DESCRIPTION: Plants short-lived perennials, densely pubescent; trichomes sessile or on a short stalk, roughly granular, the rays numerous but distinct at their bases, forked and often bifurcate; stems 0.3-1.5 dm long, decumbent, slender and unbranched, arising laterally from the simple caudex; basal leaves 1-4 (6) cm long, 4-10 (15) mm wide, the blades broadly triangular to rhombic or elliptic, often sinuate or shallowly lobed, narrowing gradually or abruptly to the slender petiole, this sometimes lobed and the leaf pinnatifid; cauline leaves 0.5-1.5 cm long, 2-6 mm wide, elliptic and narrowing to a short petiole; inflorescences compact, the buds ellipsoid; sepals 5-7.5 mm long, oblong to elliptic, boat-shaped, the lateral ones markedly saccate; petals yellow, 8-10 mm long, 1.5-2.5 mm wide, narrowly spathulate; filaments slender, not dilated, paired stamens 5.5-7 mm long, single stamens 4-6 mm long; glandular tissue roughly pentagonal around the single

stamens and subtending the paired, but absent between these; infructescences elongated or dense, often secund; pedicels 4-10 mm long, more or less sigmoid; siliques 5-9 mm long, substipitate, elliptic and strongly obcompressed but not keeled, the valves pubescent on the exterior and usually glabrous on the interior; septum entire and smooth, the funicles attached about 1/3 their lengths; styles 2-4 mm long, sometimes pubescent at the base, stigmas slightly expanded; ovules 5-8 per locule; seeds about 2 mm long, suborbicular to oblong and only slightly flattened, reddish-brown, neither margined nor winged; cotyledons exactly or obliquely accumbent, as long as or slightly shorter than the radicle (adapted from Rollins 1950).

LOCAL FIELD CHARACTERS: Slender, prostrate, spatulate-leaved stems, and obcompressed (compressed at right angles to the suture) fruits, distinguish this species from all other Lesquerella currently known to occur in Montana (except L. carinata). Like L. carinata, L. paysonii has obcompressed fruits, however, the sutures of the fruits are merely raised-lineate, and the margins are more rounded in L. paysonii. Again, because of the difficulties involved in identification of this species, specimens with mature fruits should be determined by an expert in the field for certain verification. Figure 2, p. 6, is an illustration of L. paysonii.

PRESENT LEGAL OR OTHER FORMAL STATUS

FEDERAL STATUS

Lesquerella carinata: Lesquerella carinata is included in category 3C by the U.S. Fish and Wildlife Service (U.S. Department of Interior, Fish and Wildlife Service 1985). This category includes "(t)axa that have proven to be more abundant or widespread than was previously believed. Should further research, or changes in land use indicate significant decline in any of these taxa, they may be reevaluated for possible inclusion in category 1 or 2." Lesquerella carinata was placed in this category when it was found to be more common in south-central Idaho.

The U.S. Forest Service list of sensitive species for Region 1 (Northern Region) currently includes L. carinata (U.S. Department of Agriculture 1988). Objectives and policy of the U.S. Forest Service provide for the management and protection of sensitive species under sections 2670.22 and 2670.32 in the 1984 Forest Service Manual. Under these guidelines the Forest Service is to: (a) "(m)aintain viable populations of all native species of plants" (2670.22), and to (b) "(a)void or minimize impacts to species whose viability has been identified as a concern" (2670.32.3).

Lesquerella paysonii: Lesquerella paysonii is not currently listed by the U.S. Fish and Wildlife Service.

Lesquerella paysonii was not known from Region 1 of the U.S. Forest Service prior to Dr. Rollins' determination of the Emerine Gulch population. This species is now known from a single population on the Deerlodge National Forest. It is recommended that it be included in the list of sensitive plant species for Region 1.

STATUS WITHIN STATES

Lesquerella carinata: Lesquerella carinata is listed by the Montana Natural Heritage Program (Shelly 1990) as "critically imperiled because of extreme rarity in Montana" (state rank S1, 5 or fewer occurrences). This species is also ranked as "apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery" (global rank G4).

Lesquerella paysonii: Lesquerella paysonii is listed as "critically imperiled because of extreme rarity in Montana" (state rank S1, 5 or fewer occurrences) by the Montana Natural Heritage Program. It has a similar rank in Idaho (Bob Moseley, Idaho Natural Heritage Program, pers. comm.). Lesquerella paysonii is also listed as "imperiled in Wyoming" (state rank S2, 6 to 20 occurrences) by the Wyoming Natural Diversity Database (Marriott 1990). This species is also ranked as imperiled globally because of rarity (global rank G2, 6 to 20 occurrences) (Marriott 1990).

These global and state ranks do not currently provide any protection for L. carinata or L. paysonii.

ABUNDANCE

Lesquerella carinata: Lesquerella carinata populations in Montana are large, ranging from one thousand to tens of thousands of plants estimated per population. The largest population, Rattler Gulch (003), contains eight large subpopulations, and extends nearly 2.5 miles across several ridges into Mulkey Gulch. In 1990, a subpopulation on Rattler Gulch was much reduced in size. Research revealed that this was due to aerial spraying for spotted knapweed with Tordon, on adjacent private land. It is not known if this subpopulation will recover.

Lesquerella carinata has a localized distribution in Idaho, but is common within that area. In Wyoming it has a more limited distribution with only four known locations; the identity of two of these is questionable due to the immaturity of the fruit on available specimens (Hollis Marriott, pers. comm.).

Lesquerella paysonii: The L. paysonii population at Emerine Gulch (001) contains approximately 20,000 individuals. The population size at this site appeared to remain constant over two years, but the population center has shifted. Monitoring plots could reveal changes in population age structure, and aid researchers in understanding the population dynamics of this species.

In Wyoming there are 16 locations reported for L. paysonii (Hollis Marriott, Wyoming Natural Diversity Database, pers. comm.), however, the identity of five sites is uncertain, owing to the lack of specimens with mature fruit. There is only one recorded population in Idaho (Bob Moseley, Idaho Natural Heritage Program, pers. comm.)

HABITAT

Lesquerella carinata: In Montana, L. carinata populations occur on open, dissected slopes that vary from 5 to 35 percent slope. This species is found primarily on south-facing slopes, often beneath limestone outcrops, or along obvious bands of limestone substrate. Populations occur from 4,000-4,600 ft. (1,220-1,400 m) in elevation. This is in contrast to populations in Wyoming and Idaho which occur at elevations greater than 6,400 ft. (1950 m) (Rollins and Shaw 1973). Also, not all the populations in Wyoming occur on limestone substrates, and it is not known if these soils are even calcareous (Hollis Marriott pers. comm.).

All three Montana populations (Rattler Gulch (003), Bear Creek Cliffs (004), Felan and Packer Gulches (005)) occur on loose, somewhat gravelly soils derived from Mission Canyon limestone of the Madison Group (Kauffman 1963). The band of limestone underlying the Rattler Gulch (003) subpopulations has been sampled, and is considered a high-calcium limestone. High-calcium limestone contains at least 95 percent calcium carbonate (CaCO_3) by weight, not more than 2 percent magnesium carbonate (MgCO_3) and, in most specifications, less than 3 percent insoluble impurities such as silica, iron oxide, and alumina. Only one sample out of seven along the band had greater than 2 percent MgCO_3 (Landreth 1968). Figure 3, p. 11, shows the subpopulations of Rattler Gulch (003) superimposed on a map by Landreth (1968), of the high-calcium limestone zone (including sample sites). The distribution of subpopulations suggests that L. carinata may be tied to the geochemistry of the high calcium substrate. On the other hand, the distribution may merely be an artifact of the species' ability to survive in an austere environment where competition from other plant species is low. The sampling did not extend to Packer and Felan Gulches (003), or to the Bear Creek Cliffs (004) sites. These sites are also underlain by Mission Canyon limestone (Kauffman 1963), but the quality of the limestone is not known.

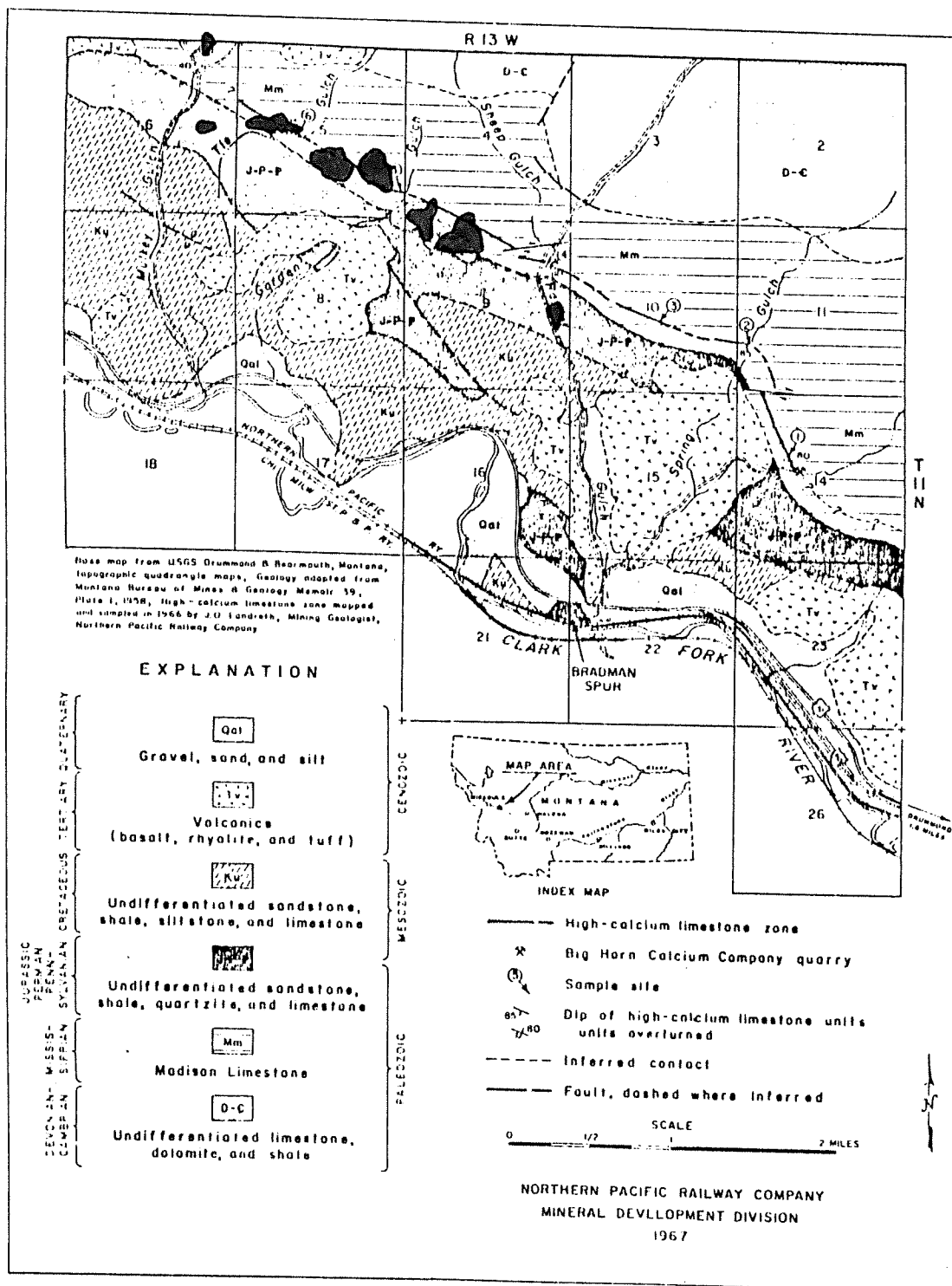


Figure 3.

Geologic map of high-calcium limestone in the Rattler Gulch area, Granite County, Montana (from Landreth 1968). Location of Rattler Gulch (003) subpopulations of *Lesquerella carinata* superimposed in red. Note the correlation of subpopulations with the high-calcium limestone zone.

Although populations do occur beneath open forest canopies of Pinus ponderosa with some Pseudotsuga menziesii and Juniperus scopulorum, the largest subpopulations were more often in open, low, bitter-brush/grassland habitats. These sites key most closely to the Pinus ponderosa/Purshia tridentata habitat type, Agropyron spicatum phase as described by Pfister *et al.* (1977). However, several species listed as constants in this type, Amelanchier alnifolia, Symphoricarpos albus, and Balsamorhiza sagittata, do not occur with L. carinata. These sites might also be ecotonal to the Purshia tridentata/Agropyron spicatum habitat type of Mueggler and Stewart (1980). Again however, Balsamorhiza sagittata is a constant in this type, but is not present in the L. carinata sites.

Plants commonly found to occur with L. carinata at one or more locations include:

Agropyron spicatum (bluebunch wheatgrass)
Alyssum alyssoides (pale alyssum)
Arabis holboellii (Holboell's rockcress)
Arabis nuttallii (Nuttall's rockcress)
Artemisia frigida (fringed sagewort)
Astragalus missouriensis (Missouri milk-vetch)
Centaurea maculosa (spotted knapweed)
Chrysothamnus nauseosus (common rabbitbrush)
Collinsia parviflora (small-flowered blue-eyed mary)
Cryptantha celosioides (northern cryptantha)
Delphinium bicolor (little larkspur)
Dodecatheon conjugens (slimpod shooting star)
Erigeron compositus (cut-leaved daisy)
Erysimum asperum (plains wallflower)
Festuca idahoensis (Idaho fescue)
Festuca scabrella (rough fescue)
Gutierrezia sarothrae (broom snakeweed)
Juniperus scopulorum (Rocky Mountain juniper)
Koeleria macrantha (prairie junegrass)
Lesquerella alpina (alpine bladderpod)
Lithospermum ruderales (western gromwell)
Lomatium cous (Cous biscuit-root)
Mahonia repens (creeping Oregon grape)
Penstemon eriantherus (fuzzytongue penstemon)
Phlox caespitosa (tufted phlox)
Pinus ponderosa (ponderosa pine)
Poa secunda (Sandberg's bluegrass)
Pseudotsuga menziesii (Douglas fir)
Prunus virginiana (common chokecherry)
Purshia tridentata (bitter-brush)
Senecio canus (woolly groundsel)
Verbascum thapsus (common mullein)

Photographs of L. carinata in flower, and the habitat of the species, are found in Section V, pp. 20-32.

Lesquerella paysonii: The L. paysonii subpopulations also occur on open, dissected slopes similar to the L. carinata sites. Nonetheless, small differences in the vegetation associated with each species is notable. The L. paysonii site does not include Purshia tridentata, and trace numbers of Artemisia tridentata are present. Also, Agropyron spicatum is the dominant cover species (25-35 percent cover), with all other species occurring in trace amounts. Finally, the L. paysonii population occurs at a slightly higher elevation (5,600 ft. (1706 m)) than the L. carinata populations in Montana. This site keys most closely to the Agropyron spicatum/Poa secunda habitat type of Mueggler and Stewart (1980).

Plants occurring with L. paysonii at Emerine Gulch include:

Achillea millefolium (common yarrow)
Agropyron spicatum (bluebunch wheatgrass)
Artemisia tridentata (big sagebrush)
Artemisia frigida (fringed sagewort)
Campanula rotundifolia (lady's thimble)
Chaenactis douglasii (hoary chaenactis)
Cirsium vulgare (bull thistle)
Cryptantha celosioides (northern cryptantha)
Delphinium bicolor (little larkspur)
Erigeron compositus (cut-leaved daisy)
Eriogonum flavum (yellow buckwheat)
Gilia congesta (ballhead gilia)
Haplopappus armerioides (thrift goldenweed)
Koeleria macrantha (prairie junegrass)
Linum perenne (blue flax)
Penstemon aridis (stiff-leaf penstemon)
Phlox kelseyi var. missoulensis (Kelsey's phlox)
Phlox muscoides (moss phlox)
Pinus ponderosa (ponderosa pine)
Poa secunda (Sandberg's bluegrass)
Senecio canus (woolly groundsel)
Taraxacum officinale (common dandelion)
Townsendia hookeri (Hooker's townsendia)
Tragopogon dubius (goat's beard)
Viola adunca (hook violet)

Photographs of L. paysonii in flower, and the habitat of the species are found in Section VI, pp. 33-39. Also, it is important to note that this site contains Phlox kelseyi var. missoulensis (Kelsey's phlox), a species on the Watch List for Region 1 of the U.S. Forest Service.

REGIONAL CLIMATE

Although just west of the continental divide, populations of L. carinata and L. paysonii occur in a region of Montana that is

generally dominated by dry, continental climate. Much of the yearly precipitation falls as rain or wet snow in May and June, with large convective storms providing the mid- and late summer moisture. Winters are cold and dry, with precipitation occurring mostly in the form of snow. For both L. carinata and L. paysonii populations, the nearest long term climatological station is at the Philipsburg Ranger Station, at an elevation of 5,270 ft. (1605 m). The station is located approximately 13 air miles northeast and about 400 ft. (120 m) lower than the L. paysonii population at Emerine Gulch (001), while the populations at Rattler Gulch (003), Bear Creek (004), and Felan and Packer Gulches (005) are all about 1,000 ft. (305 m) lower and approximately 25 miles north of the station. The mean annual temperature at the station for the time period 1951-1980 was 40.8° F (5° C). The mean maximum temperature for July was 80.5° F (27° C), while the mean minimum temperature for January was 11.5° F (-11.5° C). Mean annual precipitation was 14.22 in. (361 mm) (U.S. Department of Commerce 1982).

Ecology

None of the species in the genus Lesquerella are adapted to wet habitats, and instead tend to occupy more open and often xeric situations. Although some species tolerate shading, most seem to prefer open sites with mixed, sparse vegetation, and low growing plants (Rollins and Shaw 1973). Both L. carinata and L. paysonii occur in open, sparsely vegetated sites in Montana, where interspecific competition is low. The high canopy cover of Centaurea maculosa (spotted knapweed) within several of the roadside subpopulations of L. carinata is the exception. It is not known if the presence of spotted knapweed is detrimental to these subpopulations.

Populations of both species in Idaho and Wyoming generally occur at much higher elevations (5,500-10,000 ft. (1675-3050 m), and subsequently flowering and fruiting extends from June through July.

REPRODUCTIVE BIOLOGY

Cross-pollination is the norm in the genus Lesquerella as a whole, with bees and flies the most commonly observed pollinators (Rollins and Shaw 1973).

From observations of several populations over a two year period, L. carinata and L. paysonii both appear to be short-lived perennials (pers. obs.). This is in agreement with observations by Rollins and Shaw (1973). In Montana, flowering for both species usually begins in late May, with flowering and fruiting extending into July. Flower and fruit maturation appear to correspond with the high precipitation normals common to the area in May and June. Fruits contain from 4-7 ovules in L. carinata,

and from 5-8 ovules in L. paysonii. Both species often produce greater than 25 fruits per plant, and high levels of reproduction through seedling establishment were observed in the Montana populations of both species. A check of one population of L. carinata in mid-December revealed no plants with fruits of the year, and only a few small rosettes present. More study is necessary to determine if this species is a strict biennial.

LAND OWNERSHIP

Lesquerella carinata: The Rattler Gulch (003) and Felan and Packer Gulches (005) populations occur on both Bureau of Land Management lands, Dillon District, Garnet Resource Area, and on privately owned land. The Bear Creek Cliffs (004) population is on private land. The unverified population at Nemesis Mountain (001) is on lands managed by the Beaverhead National Forest, Dillon District.

Lesquerella paysonii: The population at Emerine Gulch (001) occurs on lands managed by the Deerlodge National Forest, Philipsburg Ranger District.

ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

Lesquerella carinata: Although plants were not observed to be grazed, L. carinata populations are affected by the trampling associated with grazing, and loss of plants was observed at the Rattler Gulch (003) site. Importation of exotic plant species by grazers may also pose a threat, especially the strong competitor Centaurea maculosa (spotted knapweed).

The area to the east of Rattler Gulch (003) may have supported a large population of L. carinata in the past, but a large limestone quarry has been in operation at this location periodically since 1939, and eliminated much potential habitat (Landreth 1968). This private property has been unsurveyed, and it is unknown if any remnant populations exist here.

In 1990, a reduction in numbers of individuals of L. carinata, Purshia tridentata, and other dicotyledonous plants was observed in a subpopulation at Rattler Gulch (003). Private lands nearby were aerially sprayed with Tordon as recently as 1989. A resurvey of the subpopulation should yield information on whether or not recruitment from the seed bank and reestablishment of the subpopulation is possible. Individuals involved in weed programs for federal, state and private agencies should be made aware of rare plant populations on public lands, especially those that occur near roadways.

Lesquerella paysonii: The Emerine Gulch population has only a few weedy species associated with the site. Centaurea maculosa (spotted knapweed) does occur to the south of this population,

but is currently found only along the banks of adjacent West Fork of Rock Creek. Grazing also occurs in this area, but impacts from grazing, whether direct or indirect, appear to be minor. Again, individuals involved in weed programs for federal, state and private agencies should be made aware of this rare plant population.

MANAGEMENT PRACTICES AND RESPONSE, AND RECOMMENDATIONS FOR MAINTAINING VIABLE POPULATIONS

Lesquerella carinata: Populations of L. carinata in Montana may have an edaphic restriction to high-calcium limestone sites. Because of the limited distribution of this species, every effort should be made to conserve populations on public lands in the state. Weed control managers should be made aware of the locations of L. carinata, so that populations are not inadvertently eliminated.

Lesquerella paysonii: The Emerine Gulch (001) site is important due to the presence of Lesquerella paysonii and Phlox kelseyi var. missoulensis. Both are species with very limited distributions. Every effort should be made to preserve the site through limitation of human-caused impacts. Here again, weed control managers should be made aware of the locations of L. paysonii, so that populations are not inadvertently eliminated.

RECOMMENDATIONS FOR FURTHER ASSESSMENT

Lesquerella carinata: On the recommendation of Dr. Reed C. Rollins, a full collection of specimens containing plants with fruits in an advanced stage of development should be collected from the Lesquerella carinata sites in 1991. In his letter to the Montana Natural Heritage Program dated November 20, 1990, he theorizes that our populations of L. carinata might be very different from populations in Idaho or Wyoming, possibly at the subspecific level.

The establishment of long-term monitoring plots at Rattler Gulch (003) would provide useful information on the life history characteristics of this species. In addition, observations of the subpopulation which has been reduced in size due to weed control activities could yield useful management information.

Lesquerella paysonii: Much of the low-elevation habitat with potential to support populations of L. paysonii has been surveyed on the Deerlodge National Forest without success. High elevation sites on the Forest were not surveyed, and there is still a chance that this species might be found at elevations more similar to Idaho and Wyoming populations.

The importance of this single disjunct population of L. paysonii

cannot be overstated. The establishment of a long-term monitoring plot at Emerine Gulch (001) would provide useful information on the life history characteristics of this species, and provide insight into potential management implications for this population.

IV. LITERATURE CITED

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V. Lesquerella carinata: ELEMENT OCCURRENCE PRINT-OUTS, MAPS,
PHOTOGRAPHS

ELEMENT OCCURRENCE RECORD
Lesquerella carinata

21

Occurrence number: 001

Global rank: G4 Forest Service status: SENSITIVE LIST
State rank: S1 Federal Status: 3C

Survey site name: NEMESIS MOUNTAIN
EO rank:
EO rank comments:

County: BEAVERHEAD

USGS quadrangle: MOUNT JEFFERSON

Township-range: 014S 002E Section: 31 Precision: S
Township-range comments: NW4

Survey date:	Elevation: 9339
First observation: 1979	Slope/aspect:
Last observation: 1979-06-20	Size (acres): 0

Location:

SUMMIT OF PEAK JUST ESE. OF NEMESIS MOUNTAIN, CENTENNIAL MOUNTAINS.

Element occurrence data:
RARE.

General site description:
ALPINE SCREE SLOPE AT SUMMIT.

Land owner/manager:
BEAVERHEAD NATIONAL FOREST, MADISON RANGER DISTRICT

Comments:
VOUCHER-LOWRY II, P. (2090), 1979, MONT (68303). NOTE: SPECIMEN TAKEN
IN FLOWER, AND PREVIOUS YEAR'S FRUIT IS IN POOR CONDITION; POPULATION
NEEDS TO BE SURVEYED, TO VERIFY IDENTIFICATION.

Information source:
LOWRY II, P.P. 1979. VASCULAR PLANTS OF THE CENTENNIAL MOUNTAINS
INSTANT STUDY AREA, BLM, BUTTE DISTRICT. 57 PP.

ELEMENT OCCURRENCE RECORD

22

Lesquerella carinata

Occurrence number: 003

Global rank: G4 Forest Service status: SENSITIVE LIST
State rank: S1 Federal Status: 3C

Survey site name: RATTLER GULCH

EO rank: B

EO rank comments: VERY EXTENSIVE POPULATION COVERING A
LARGE AREA. KNAPWEED INVASION IS
EXTENSIVE; AREA HEAVILY TERRACED BY
GRAZING.

County: GRANITE

USGS quadrangle: DRUMMOND
BEARMOUTH

Township-range: 011N 013W Section: 09 Precision: S

Township-range comments: NW4, NE4SE4, Section 4 SE4SW4, SW4SW4, Section 5
SE4, SE4NW4, SW4NW4, Section 6 NE4SE4, NE4NE4; T012N R013W: Section 31
SE4SE4

Survey date: 1990-06-12 Elevation: 4050
First observation: 1973 Slope/aspect: 0-35% / SE TO SW
Last observation: 1990-06-12 Size (acres): 120

Location:

RATTLER GULCH, CA. 5 MILES WEST OF DRUMMOND. SUBPOPULATIONS EXTEND
FROM EAST OF RATTLER GULCH ROAD, BELOW CLIFFS, WEST FOR 2.5 MILES TO
MULKEY GULCH.

Element occurrence data:

1984 RATTLER GULCH SUBPOPULATION OF 1001-10000 PLANTS MUCH REDUCED IN
1990, DUE TO HERBICIDE APPLICATION ON NEARBY PRIVATE LANDS. ADDITIONAL
LARGE SUBPOPULATIONS (TOTAL > 100,000 INDIVIDUALS) EXTEND WEST TO
MULKEY GULCH.

General site description:

DRY, STEEP SOUTH AND WEST SLOPES ABOVE A DRY GULCH; SOILS ROCKY,
YELLOWISH, SHALLOW, AND LIMESTONE-DERIVED; WITH SCATTERED PINUS
PONDEROSA, JUNIPERUS SCOPULORUM, FESTUCA SCABRELLA, AGROPYRON SPICATUM,
ERIGERON COMPOSITUS, ERYSIMUM ASPERUM, PHLOX HOODII, LESQUERELLA
ALPINA. ALSO, LOMATIUM TRITERNATUM, PURSHIA TRIDENTATA, LINUM PERENNE,
CRYPTANTHA CELOSIODES, KOELERIA CRISTATA, CHRYSOTHAMNUS NAUSEOSUS,
ACHILLEA MILLEFOLIUM, AGOSERIS GLAUCA, PINUS FLEXILIS, CREPIS
OCCIDENTALIS, HAPLOPAPPUS ACAULIS, PHLOX CAESPITOSA, AND ASTRAGALUS
MISSOURIENSIS.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
BLM: GARNET RESOURCE AREA, BUTTE DISTRICT

ELEMENT OCCURRENCE RECORD
Lesquerella carinata

23

Occurrence number: 003 (continued)

Comments:

POPULATION COVERS EXTENSIVE AREA, BUT IS RESTRICTED TO A NARROW BAND OF HIGH CALCIUM LIMESTONE. VOUCHER - SCHASSBERGER, L.A. (260), 1989, MONTU; (364, 366), 1990, GRAY HERBARIUM. ADDITIONAL VOUCHERS: LACKSCHEWITZ, K. (7172, 7373), 1977, SPECIMEN NUMBERS 78623 & 78624 (MONTU); LESICA, P. (2935), 1984, SPECIMEN #72490 (MONTU).

Information source:

SCHASSBERGER, L.A. 1990. FIELD SURVEYS OF GRANITE COUNTY OF 11-15 JUNE (LESQUERELLA CARINATA, PHLOX KELSEYI VAR. MISSOULENSIS, AND CLAYTONIA LANCEOLATA VAR. FLAVA).

ELEMENT OCCURRENCE RECORD
Lesquerella carinata

24

Occurrence number: 004

Global rank: G4 Forest Service status: SENSITIVE LIST
State rank: S1 Federal Status: 3C

Survey site name: BEAR CREEK CLIFFS
EO rank: B
EO rank comments: FAIRLY LARGE, VIGOROUS POPULATION; SOME
DISTURBANCE.

County: GRANITE

USGS quadrangle: BEARMOUTH

Township-range: 011N 014W Section: 11 Precision: S
Township-range comments: NE4

Survey date: 1986-05-05 Elevation: 4600
First observation: 1986 Slope/aspect:
Last observation: 1989-05-26 Size (acres): 0

Location:

CLIFFS ABOVE EAST SIDE OF BEAR CREEK, 1.3 AIR MILES NNE OF BEARMOUTH,
CA. 0.4 AIR MILES NORTH OF CLARK FORK.

Element occurrence data:

1986: 101-1000 INDIVIDUALS, FLOWER AND IMMATURE FRUIT. 1989: 20 PLANTS
RELOCATED.

General site description:

UPPER WEST-FACING SLOPES, CHOPPY LIMESTONE CLIFFS; FESTUCA
IDAHOENSIS/AGROPYRON SPICATUM GRASSLAND, WITH POA SECUNDA, ALYSSUM
SP., BROMUS, CENTAUREA.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

NONE.

Information source:

LESICA, P. DIVISION OF BIOLOGICAL SCIENCES, UNIV. OF MONTANA,
MISSOULA, MT 59812. (3697). 1986. SPECIMEN # 04163. MONTU.

ELEMENT OCCURRENCE RECORD
Lesquerella carinata

25

Occurrence number: 005

Global rank: G4 Forest Service status: SENSITIVE LIST
State rank: S1 Federal Status: 3C

Survey site name: FELAN AND PACKER GULCHES
EO rank: B
EO rank comments: EXTENSIVE KNAPWEED INVASION.

County: GRANITE

USGS quadrangle: BEARMOUTH

Township-range: 012N 014W Section: 33 Precision: S
Township-range comments: SE4, Section 34 SW4; T011N R014W: Section 3 NW4;
T012N R014W: Section 34 SW4

Survey date: 1990-06-11 Elevation: 4400
First observation: 1989 Slope/aspect: 8-35% / SW
Last observation: 1990-06-12 Size (acres): 30

Location:

BEARMOUTH AREA, FELAN AND PACKER GULCHES, CA. 2.3 MILES NORTH OF I-90
UP BEAR CREEK.

Element occurrence data:

1989: TWO LARGE, VIGOROUS SUBPOPULATIONS, FLOWERING AND FRUITING.
1990: POPULATION AT PACKER GULCH WAS GREATLY REDUCED IN SIZE, POSSIBLY
DUE TO DROUGHT, FREEZING, HERBICIDE USE, OR THE SHORT-LIVED NATURE OF
THIS PERENNIAL SPECIES. POPULATION AT FELAN GULCH WAS SLIGHTLY
REDUCED, PROBABLY DUE TO THE SAME CAUSES.

General site description:

ON CALCAREOUS SOILS, WITH PINUS PONDEROSA, JUNIPERUS SCOPULORUM,
PURSHIA TRIDENTATA, ERIGERON COMPOSITUS, MAHONIA REPENS, AND CENTAUREA
MACULOSA.

Land owner/manager:

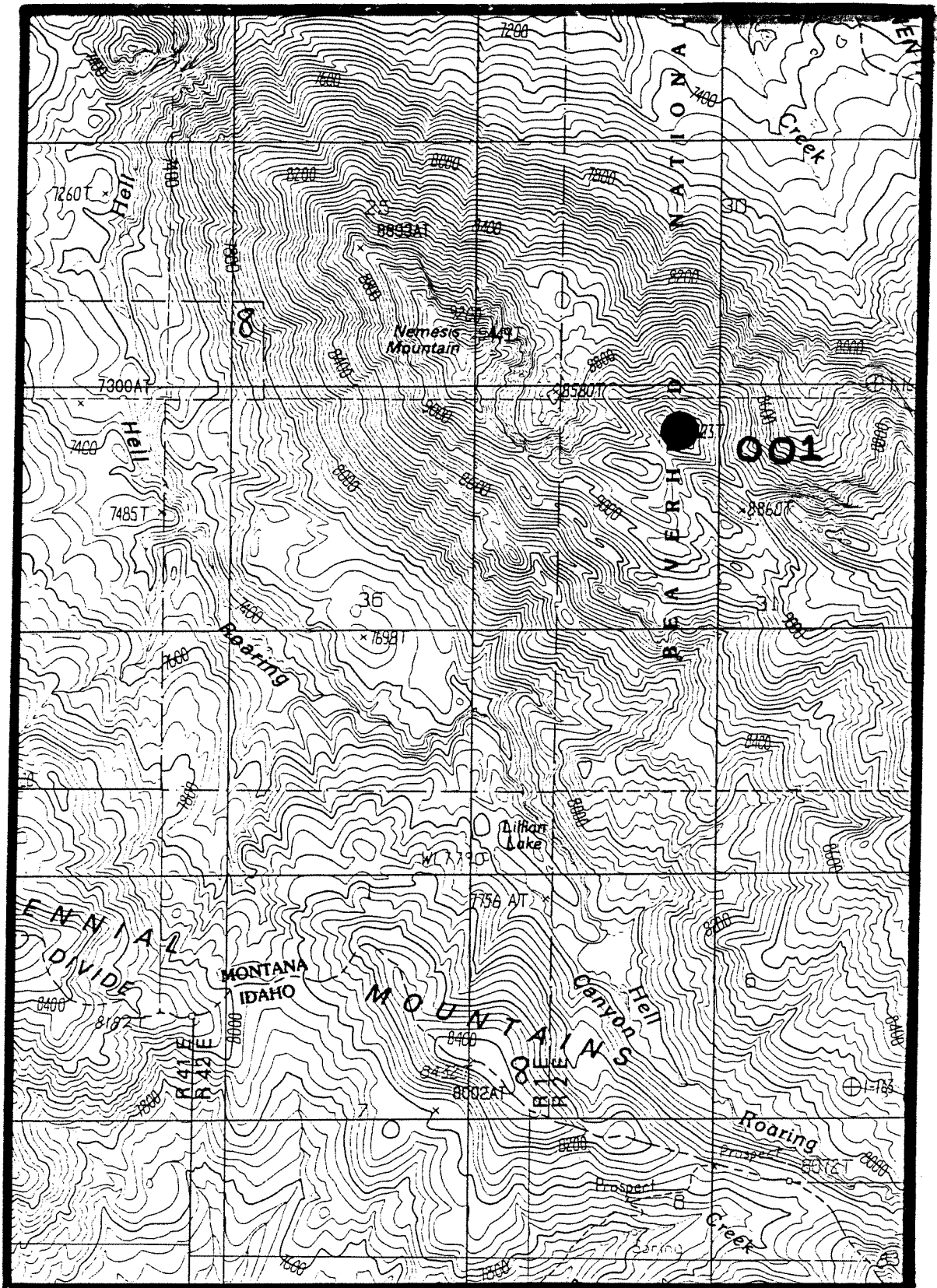
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
BLM: GARNET RESOURCE AREA, BUTTE DISTRICT

Comments:

VOUCHER - SCHAASSBERGER, L.A. (262, 263), 1989, (MONTU); (365, 366),
1990, GRAY HERBARIUM.

Information source:

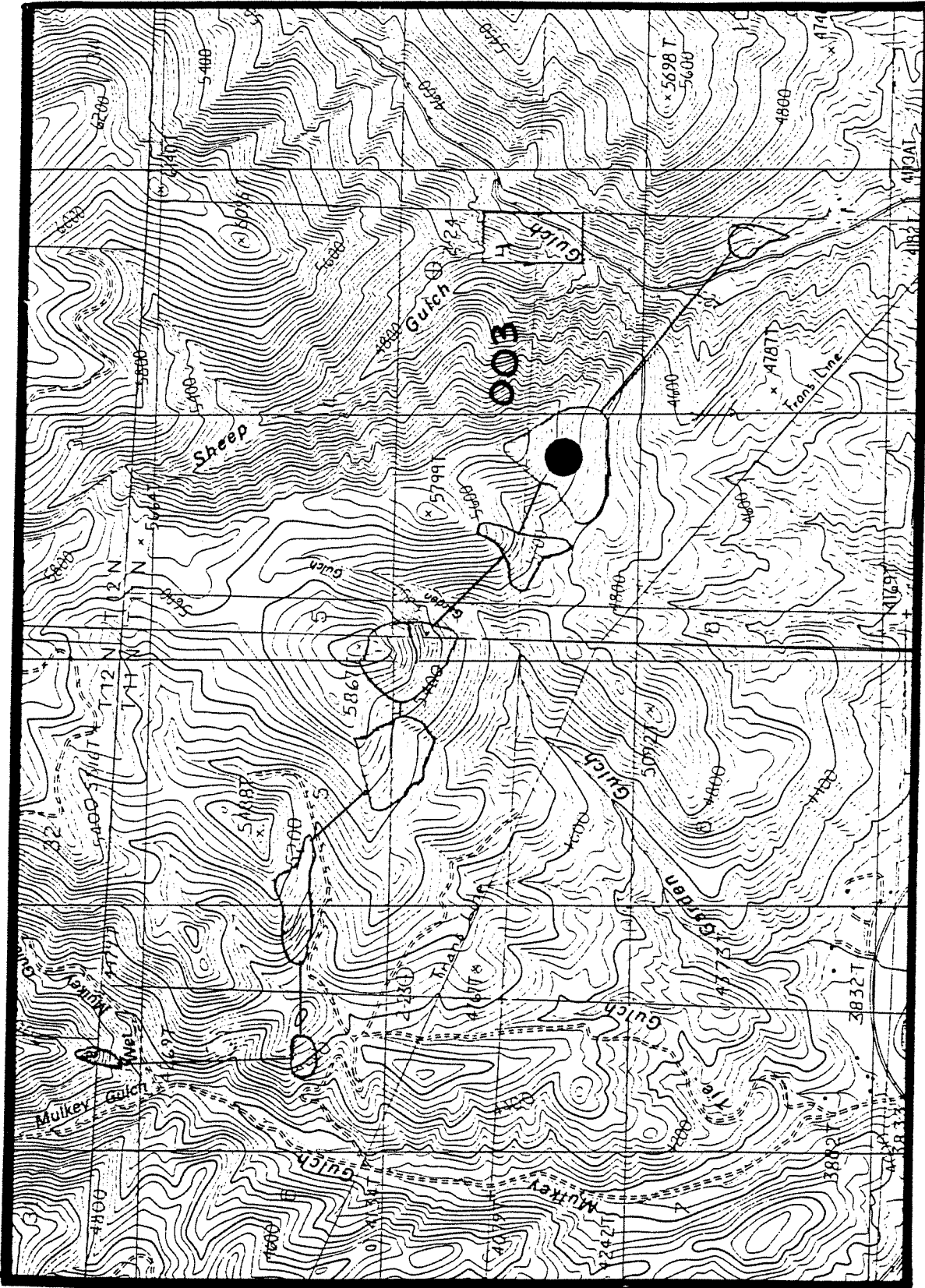
SCHAASSBERGER, L.A. 1990. FIELD SURVEYS OF GRANITE COUNTY OF 11-15 JUNE
(LESQUERELLA CARINATA, PHLOX KELSEYI VAR. MISSOULENSIS, AND CLAYTONIA
LANCEOLATA VAR. FLAVA).



U.S.G.S. Mount Jefferson Quadrangle (7.5')

Lesquerella carinata - Nemesis Mountain (001)

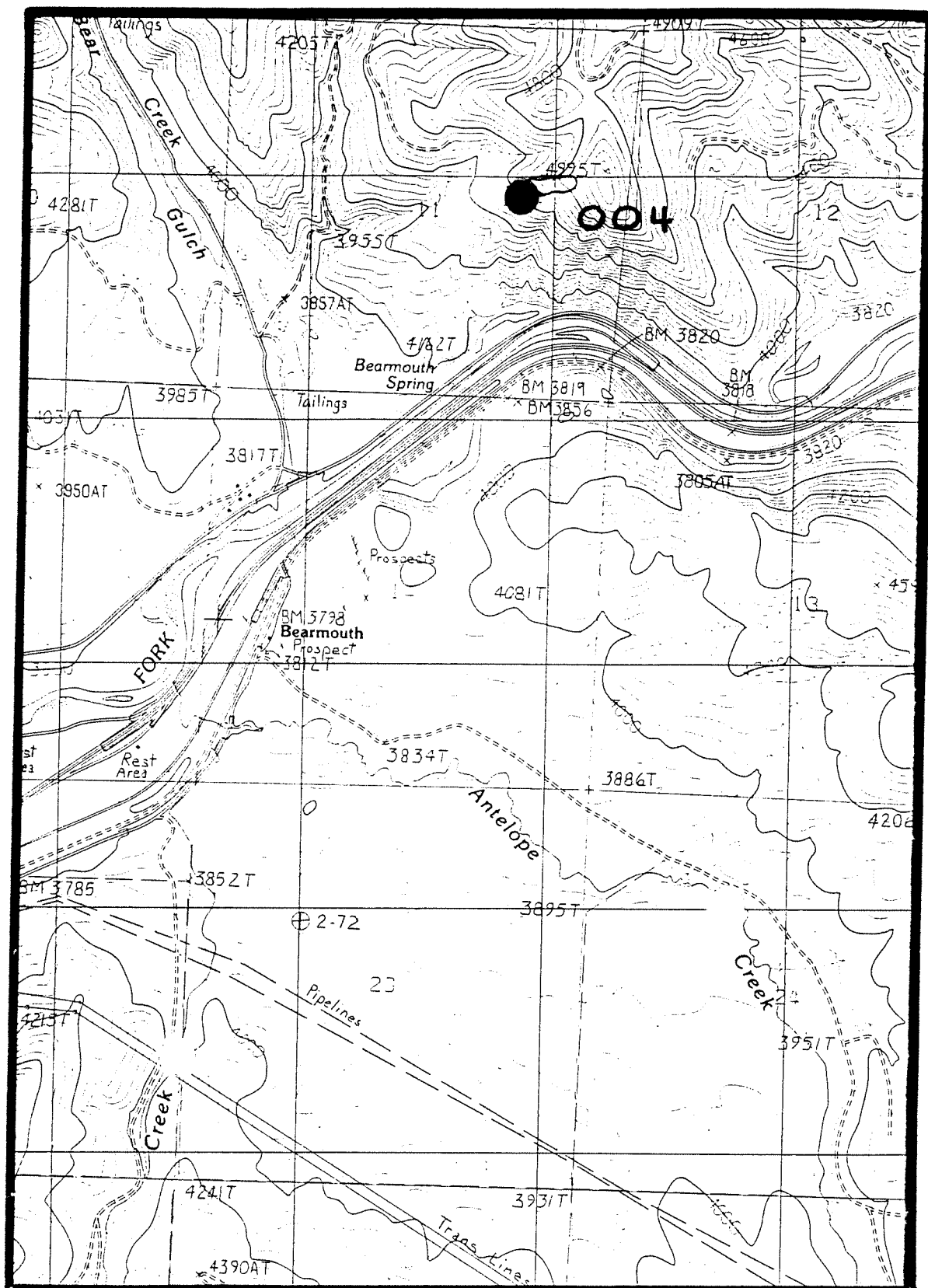
MONTANA



U.S.G.S. Bearmouth Quadrangle (7.5') - Left

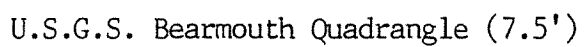
U.S.G.S. Drummond Quadrangle (7.5') - Right

Lesquerella carinata - Rattler Gulch (003)



U.S.G.S. Bearmouth Quadrangle (7.5')

Lesquerella carinata - Bear Creek Cliffs (004)



Lesquerella carinata - Felan and Packer Gulches (005)



- A. Lesquerella carinata - in flower (Felan and Packer Gulches (005)). Erigeron compositus (white flowers) and Centaurea maculosa (basal leaves) in lower right hand corner of photo.



B. Lesquerella carinata - habitat (Rattler Gulch (003)).



- C. Lesquerella carinata - habitat (Rattler Gulch (003)).
Population is in Mulkey Gulch, in open area just below rock
outcrop in the background.

VI. Lesquerella paysonii: ELEMENT OCCURRENCE PRINT-OUTS, MAPS, PHOTOGRAPHS

ELEMENT OCCURRENCE RECORD
Lesquerella paysonii

34

Occurrence number: 001

Global rank: G2 Forest Service status:
State rank: S1 Federal Status:

Survey site name: EMERINE GULCH
EO rank: A
EO rank comments: LARGE POPULATION IN REMOTE AREA; HABITAT
IN GOOD SHAPE.

County: GRANITE

USGS quadrangle: MAUKEY GULCH

Township-range: 006N 016W Section: 26 Precision: S
Township-range comments: S2, NW4, Section 35 NE4NW4, NW4NE4, Section 27
SE4NE4

Survey date: 1990-06-13 Elevation: 5600
First observation: 1966 Slope/aspect: 5-35% / SOUTH,
SOUTHWEST
Last observation: 1990-06-13 Size (acres): 140

Location:

TAKE HWY. 38 CA. 15 MILES FROM HWY. 10A TO JUNCTION WITH ROCK CREEK
ROAD; PROCEED WEST ON 38 CA. 2.25 MILES TO EMERINE GULCH ROAD; SITE IS
ON HILL ABOVE ROAD.

Element occurrence data:

1989: 20,000+ INDIVIDUALS IN 9 SUBPOPULATIONS. 1990: POPULATION
CENTER HAD SHIFTED, POSSIBLY DUE TO THE SHORT-LIVED NATURE OF THIS
PERENNIAL.

General site description:

STEEP, SOUTHWEST-FACING HILLSIDE, OCCASIONALLY SLUMPING CLAY-GRAVEL
SOIL; WITH AGROPYRON SPICATUM (DOMINANT), DELPHINIUM BICOLOR,
ERIOGONUM FLAVUM, PHLOX KELSEYI VAR. MISSOULENSIS, ARTEMISIA
TRIDENTATA, POA SANDBERGII, AND PHLOX MUSCOIDES. SOIL pH = 8.2 AS
MEASURED WITH COLOROMETRIC KIT. SITE IS TRAILED AND LIGHTLY GRAZED.

Land owner/manager:

DEERLODGE NATIONAL FOREST, PHILIPSBURG RANGER DISTRICT

Comments:

VOUCHERS - HARVEY, L. (7226), 1966, SPECIMEN # 59195, MONTU (DET. L.
CARINATA BY K.H. LACKSCHEWITZ, 12/85). LACKSCHEWITZ, K. (3688), 1972,
MONTU. LESICA, P. (3751), 1986, MONTU (DET. L. PAYSONII BY REED C.
ROLLINS, 11/90). SCHASSBERGER, L. (368), GH (DET. L. PAYSONII BY REED
C. ROLLINS, 11/90).

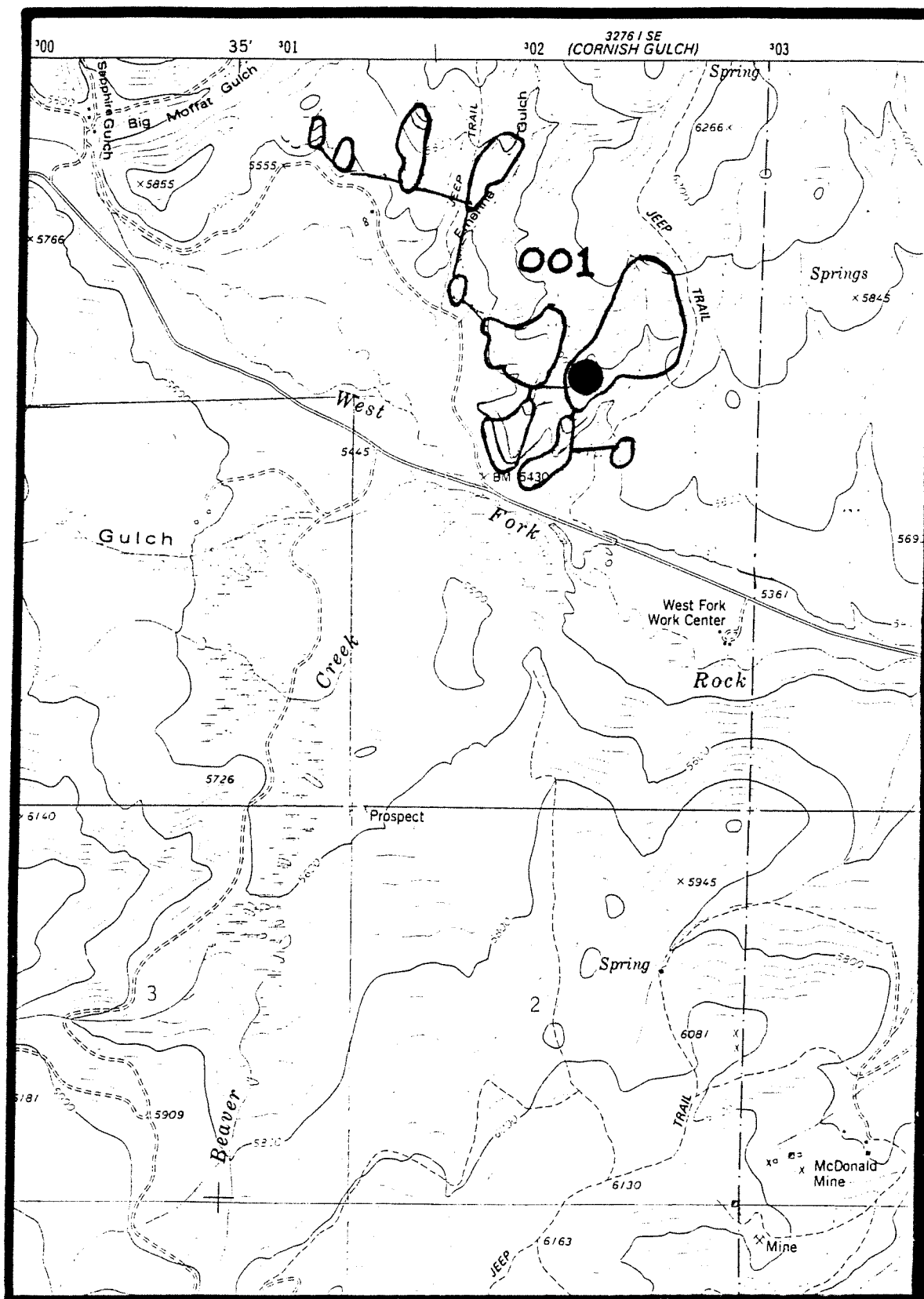
ELEMENT OCCURRENCE RECORD
Lesquerella paysonii

35

Occurrence number: 001 (continued)

Information source:

SCHASSBERGER, L.A. 1990. FIELD SURVEYS OF GRANITE COUNTY OF 11-15 JUNE
(LESQUERELLA CARINATA, PHLOX KELSEYI VAR. MISSOULENSIS, AND CLAYTONIA
LANCEOLATA VAR. FLAVA).



U.S.G.S. Maukey Gulch Quadrangle (7.5')

Lesquerella paysonii - Emerine Gulch (001)



A. Lesquerella paysonii - in flower (Emerine Gulch (001)).



- B. Lesquerella paysonii - habitat (Emerine Gulch (001)). Note vegetative cover of Agropyron spicatum. Steve Shelly working in background.



C. Lesquerella paysonii - habitat (Emerine Gulch (001)).

APPENDIX A

AREAS SURVEYED BUT SPECIES NOT LOCATED: The following areas were surveyed in 1989 or 1990, but no L. carinata or L. paysonii populations were located. The actual areas surveyed were often smaller than the portions of the sections indicated. The list is organized by township, range and section number.

T	R	SEC	$\frac{1}{4}$ SEC	OWNER/MANAGER
05N	11W	SEC10	SW $\frac{1}{4}$ SE $\frac{1}{4}$	DEERLODGE N.F./PRIVATE
05N	11W	SEC10	SE $\frac{1}{4}$ SW $\frac{1}{4}$	DEERLODGE N.F./PRIVATE
05N	11W	SEC9	NE $\frac{1}{4}$ SE $\frac{1}{4}$	DEERLODGE N.F.
05N	12W	SEC19	SE $\frac{1}{4}$ SE $\frac{1}{4}$	DEERLODGE N.F.
05N	12W	SEC20	NW $\frac{1}{4}$ SE $\frac{1}{4}$	DEERLODGE N.F.
05N	12W	SEC22	NE $\frac{1}{4}$ SE $\frac{1}{4}$	DEERLODGE N.F.
05N	15W	SEC8	SE $\frac{1}{4}$ NE $\frac{1}{4}$	PRIVATE
06N	11W	SEC11	SW $\frac{1}{4}$ SE $\frac{1}{4}$	DEERLODGE N.F.
06N	11W	SEC14	NW $\frac{1}{4}$	DEERLODGE N.F.
06N	15W	SEC29	SW $\frac{1}{4}$ SW $\frac{1}{4}$	PRIVATE
06N	15W	SEC31	NW $\frac{1}{4}$ SW $\frac{1}{4}$	PRIVATE
06N	15W	SEC32	SE $\frac{1}{4}$ SW $\frac{1}{4}$	PRIVATE
06N	16W	SEC27	NW $\frac{1}{4}$ NW $\frac{1}{4}$	DEERLODGE N.F.
07N	10W	SEC7	SE $\frac{1}{4}$	STATE
07N	10W	SEC8	SW $\frac{1}{4}$	STATE
07N	10W	SEC17	NE $\frac{1}{4}$ NE $\frac{1}{4}$	STATE
07N	14W	SEC1	SW $\frac{1}{4}$ NW $\frac{1}{4}$	PRIVATE
07N	16W	SEC25	SE $\frac{1}{4}$ NE $\frac{1}{4}$	PRIVATE
08N	11W	SEC2	NE $\frac{1}{4}$	DEERLODGE N.F.
08N	13W	SEC15	NW $\frac{1}{4}$ NW $\frac{1}{4}$	DEERLODGE N.F.
08N	13W	SEC19	SE $\frac{1}{4}$ SW $\frac{1}{4}$	PRIVATE
08N	15W	SEC30	SE $\frac{1}{4}$	DEERLODGE N.F.
09N	11W	SEC21	SE $\frac{1}{4}$ SE $\frac{1}{4}$	PRIVATE
09N	12W	SEC30	SW $\frac{1}{4}$ SW $\frac{1}{4}$	DEERLODGE N.F.
09N	12W	SEC31	NW $\frac{1}{4}$ NW $\frac{1}{4}$	PRIVATE
09N	13W	SEC24	SE $\frac{1}{4}$ NW $\frac{1}{4}$	PRIVATE
09N	13W	SEC35	SE $\frac{1}{4}$ NW $\frac{1}{4}$	PRIVATE
09N	13W	SEC36	NE $\frac{1}{4}$ NE $\frac{1}{4}$	STATE LAND
11N	13W	SEC15	SW $\frac{1}{4}$ SW $\frac{1}{4}$	PRIVATE
11N	13W	SEC16	SE $\frac{1}{4}$ NE $\frac{1}{4}$	STATE
11N	13W	SEC7	SW $\frac{1}{4}$ NE $\frac{1}{4}$	PRIVATE
11N	14W	SEC10	NE $\frac{1}{4}$ NE $\frac{1}{4}$	PRIVATE
11N	16W	SEC3	SE $\frac{1}{4}$ SE $\frac{1}{4}$	PRIVATE
11N	16W	SEC10	NW $\frac{1}{4}$ NW $\frac{1}{4}$	PRIVATE
11N	15W	SEC8	SE $\frac{1}{4}$ SW $\frac{1}{4}$	PRIVATE
11N	15W	SEC8	NW $\frac{1}{4}$ SE $\frac{1}{4}$	PRIVATE
11N	15W	SEC5	NE $\frac{1}{4}$ SE $\frac{1}{4}$	BLM
11N	15W	SEC4	SW $\frac{1}{4}$ NW $\frac{1}{4}$	BLM
11N	14W	SEC16	NW $\frac{1}{4}$ SE $\frac{1}{4}$	STATE
11N	14W	SEC16	NE $\frac{1}{4}$ SW $\frac{1}{4}$	STATE
01S	04W	SEC9	N $\frac{1}{2}$	PRIVATE
01S	04W	SEC10	NE $\frac{1}{4}$	DEERLODGE N.F.

